EVALUATE BLOCKCHAIN – BASED MARKETING PLATFORMS BY AHP TOPSIS APPROACH

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ABSTRACT

This paper delves into the profound influence of blockchain on the field of marketing, an arena that has undergone significant transformation in the wake of the digital revolution. The amalgamation of digital and physical domains has given rise to a dynamic and intensely competitive environment for marketers, prompting a reevaluation of strategies and tools. Despite the promising prospects, the research landscape surrounding blockchain-based marketing platforms remains in its nascent stages. This paper seeks to bridge this gap by identifying crucial criteria for evaluating such platforms, transcending conventional measures. The study employs the AHP-TOPSIS approach, a hybrid methodology combining the Analytic Hierarchy Process (AHP) with the Technique for Order of Preference by Similarity to Ideal Solution (TOPSIS). The overarching objectives encompass the identification, evaluation, and ranking of criteria and sub-criteria pertinent to blockchain-based marketing platform.

This paper contributes not only a comprehensive overview of blockchain's distinctive features and its potential applications in marketing but also presents a systematic framework for platform selection. By emphasizing criteria beyond traditional financial metrics, the study addresses a critical void in the current literature, providing valuable insights for marketers, researchers, and practitioners navigating the dynamic intersection of blockchain and marketing. In conclusion, this research illuminates the transformative potential of blockchain technology in marketing, offering practical guidance to industry stakeholders in a landscape increasingly shaped by digital innovation and competition.

KEYWORDS

Blockchain, Marketing platforms, Mobile-commerce, AHP, TOPSIS

1. INTRODUCTION

The emergence of blockchain technology has captured the attention of academia, industry practitioners, and policymakers worldwide due to its disruptive potential in reshaping the operations of both public and private sector organizations (Pilkington, 2016; Nowiński and Kozma, 2017). While the technology initially gained prominence through cryptocurrencies like Bitcoin in 2008, it didn't take long for researchers to recognize its potential beyond speculative digital currencies (Yermack, 2015; Antoniadis et al., 2018). Numerous studies have shed light on the transformative capacity of blockchain technology across various industries, igniting a robust discourse on its applications and disruptive influence on business models and management processes (Crosby et al., 2016; Casino et al., 2019) as it pertains to marketing.

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Marketing and marketing management have not remained untouched by the digital revolution. With the advent of the internet, information technologies, and the rise of social media and social networking sites, the landscape of how marketers engage with consumers and orchestrate their marketing campaigns in the digital realm has undergone a profound transformation (Belch and Belch, 2014; Vlahvei and Notta, 2014). The integration of the digital and physical worlds has given rise to a competitive and demanding environment for firms, brands, and marketers alike.

Despite the promising prospects and the substantial impact of blockchain-based marketing platforms, research in this area remains relatively nascent and primarily focuses on the financial applications of the technology (Zheng et al., 2018). Given this backdrop, the author has embarked on the research paper titled "Evaluating Blockchain-Based Marketing Platforms Using the AHP-TOPSIS Approach." The study aims to delve into the crucial criteria for evaluating blockchain-based marketing platforms, expanding its scope beyond conventional assessment parameters. It seeks to explore the significance of blockchain technology in the field of marketing and proposes key environmental variables that hold relevance in the platform selection process.

Within this paper, we endeavor to provide a succinct overview of the distinguishing features of blockchain technology and its potential applications while presenting a systematic and effective framework for the selection of blockchain-based marketing platforms using the AHP-TOPSIS approach. We also highlight real-world applications to illustrate the practical implications of this research. The objectives of this study are:
- Identifying important criteria and sub-criteria in blockchain-based marketing platforms
- Evaluating criteria and sub-criteria of blockchain-based marketing platforms based on the AHP – TOPSIS method.
- Raking the best blockchain-based marketing platforms through the evaluation of criteria.

The study employs a Model AHP-TOPSIS, which combines the Analytic Hierarchy Process (AHP) method with The Technique for Order of Preference by Similarity to Ideal Solution (TOPSIS), choosing blockchain-based marketing platforms.

2. LITERATURE REVIEW

A blockchain can be described as a sequential chain of data blocks stored in a decentralized manner across all the nodes that make up the blockchain network (Asharaf and Adarsh, 2017). Pierro (2017) defined blockchain is characterized as a distributed ledger employed for securely, transparently, and incorruptibly recording transactions. This technology relies on cryptographic security and operates across a computer network, rendering it impervious to control by any single entity or organization. Wasiq et al. (2023) argue that blockchain technology has disrupted traditional marketing approaches and introduced entirely contemporary marketing frameworks using its unique capabilities of decentralization, security, and transparency. According to Kaur et al. (2022) and Jevremović et al. (2022), the integration of blockchain technology into marketing has the potential to breathe new life into the field, addressing its current saturation. This technology can be leveraged in advertising and marketing to achieve improved and more streamlined outcomes. Blockchain's decentralization aspect empowers marketers and advertisers to handle data, attain a deeper understanding of customer responses to their campaigns, and foster enduring customer connections.

Blockchain has the potential to revolutionize the marketing industry by improving the efficiency, transparency, and security of campaigns. O'Leary (2018) points out that blockchain is already being used by marketers and advertisers to improve the efficiency and transparency of their campaigns. Neverstopmarketing (2019) also argues that blockchain can be used to create a decentralized and more transparent customer relationship management (CRM) system. Mire S. (2018) and Kuno Creative (2018) highlight that blockchain can help marketers collect and manage customer data more effectively, reach the right target audience with the right message, distribute content more effectively, and collect more accurate market data. Ghose A., (2018) and Forbes (2018) conclude that blockchain can revolutionize the marketing industry by providing a decentralized, transparent, and secure platform for collecting, storing, and using customer data. In today's rapidly changing business landscape, it is essential for businesses to adopt innovative and sustainable practices in order to remain competitive. Blockchain-based marketing platforms offer a number of advantages over traditional marketing platforms, including increased transparency, security, and efficiency. However, with so many blockchain-based marketing platforms available, it can be difficult to choose the right one for your business. The AHP – TOPSIS approach is a powerful decision-making tool that can be used to evaluate blockchain-based marketing platforms and other complex systems.

3. METHODOLOGY

3.1 Research process

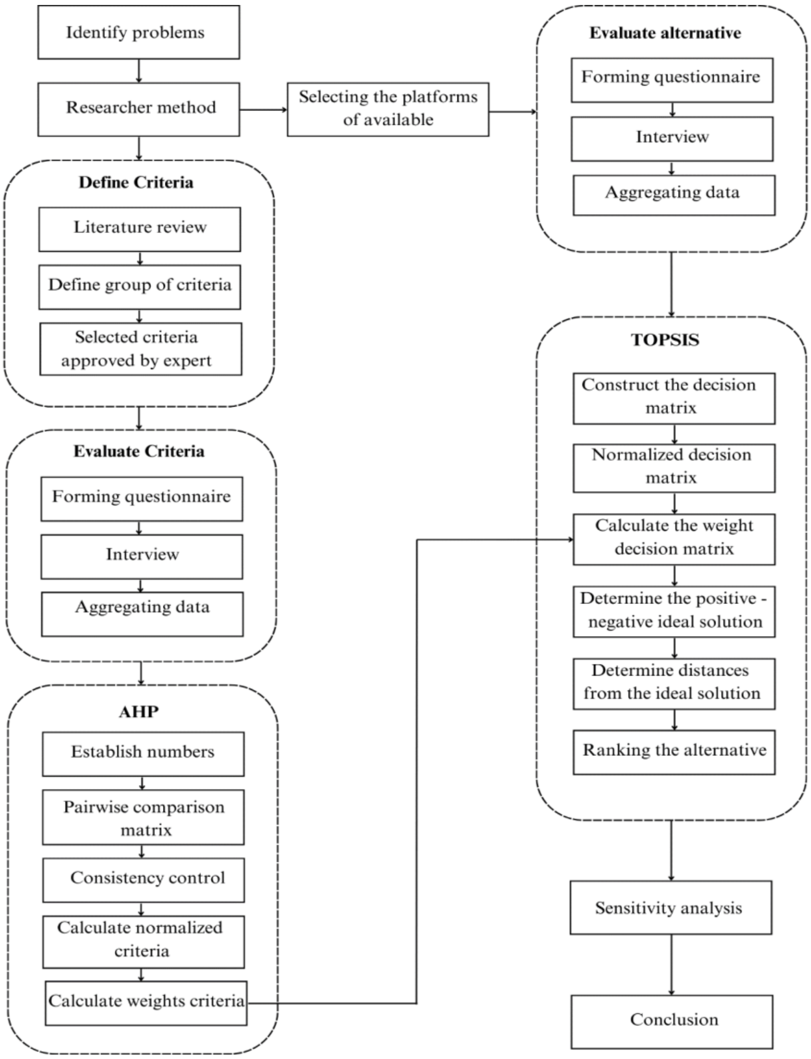

Figure 3.1. Research process

Source: Author

3.2 The proposed method

3.2.1 Criteria determination

Evaluating blockchain-based marketing platforms is a complex task. To determine the most suitable platform, the author has conducted an extensive analysis of prior research articles on blockchain platforms in marketing. Collaborating with experts, a set of criteria, along with a summary and conclusion, has been derived from this research. To assess and choose a blockchain-based marketing platform, there are five primary criteria and 14 sub-criteria detailed in Table 3.1.

Table 3.1. Criteria for evaluating and selecting blockchain-based marketing platform

		Name	Meaning	Sources
Functionality factor (C1)	C11	Features	The number and types of features that a blockchain platform supports, such as smart contracts, tokenization, decentralized applications (dApps), privacy features, security features, and scalability features.	Liu et al. (2020b) Dovlatova (2023) Dua et al. (2023) Shahr Banoo, M. (2022)
	C12	Performance	The blockchain platform performs well in terms of transaction speed, throughput, and latency.	Liu et al. (2020b) Ocampo, L. Et al. (2022) Dua et al. (2023) Shahr Banoo, M. (2022)
	C13	Integrations	The blockchain platform can be connected to other software systems and applications, allowing them to share data and interact with each other.	Dua et al. (2023) Şengül and Eren (2016) Ocampo, L. Et al. (2022) Shahr Banoo, M. (2022)
Security factor (C2)	C21	Data Security	The blockchain platform protects user data and assets from unauthorized access, theft, and loss.	Zarour et al. (2020) Karayazi and Bereketli (2021) Liu et al. (2020b) Bonab, S. R. Et al. (2023b)
	C22	Privacy	Protects user privacy and allows users to control their data.	N. A. Nabeeh et al. (2022) Zarour et al. (2020) Karayazi and Bereketli (2021) Yang et al. (2021) Shahr Banoo, M. (2022)
	C23	Access control	Allows users to control who has access to their data and assets.	Liu et al. (2020b) Karayazi and Bereketli **(2021)** Khan et al. (2022) Zarour et al. (2020) Mahad (2022)
Scalability	C31	Handle large	Handle a large number of	Liu et al. (2020b)

factor (C3)		volumes	transactions without sacrificing	N. A. Nabeeh et al. (2022) Khan et al. (2022) Zarour et al. (2020)
	C32	Scale expansion	Scale to support a growing number of users.	N. A. Nabeeh et al. (2022) Khan et al. (2022) Zarour et al. (2020) Fahmi et al. (2023) Haji et al. (2022b)
Cost factor (C4)	C41	Initial cost	The upfront cost of using a blockchain platform, such as the cost of purchasing hardware and software.	Erol, I. Et al. (2021) Khan et al. (2022) Dua et al. (2023) Kubler et al. (2023) Liu et al. (2020b)
	C42	Maintenance cost	The ongoing cost of using a blockchain platform, such as the cost of repairs, upgrades, and technical support.	Erol, I. Et al. (2021) Zarour et al. (2020) Fahmi et al. (2023) Liu et al. (2020b) Çolak et al. (2020)
	C43	Transaction fees	The fees that users pay to make transactions on a blockchain platform.	Çolak et al. (2020) Bonab, S. R. Et al. (2023b) Nagariya, R. Et al. (2023) Erol, I. Et al. (2021)
Ease of use factor (C5)	C51	User interface	How easy it is to use the blockchain platform's user interface.	Ocampo, L. Et al. (2022) Karayazi & Bereketli (2021) Yang et al. (2021) Çolak et al. (2020)
	C52	Documentation	The quality and completeness of the blockchain platform's documentation.	Ocampo, L. Et al. (2022) Shahr Banoo, M. (2022) Fahmi et al. (2023)
	C53	Customer support	The quality of the blockchain platform's customer support.	Ocampo, L. Et al. (2022) Shahr Banoo, M. (2022)

Source: Author synthesis.

3.2.2 Alternatives determination.

The alternatives correspond to platforms:

Table 3.2. Alternatives determination

Alternatives	**Code**	**Platforms**
Alternative 1	P1	Brave
Alternative 2	P2	Coinzilla
Alternative 3	P3	Adshares
Alternative 4	P4	Bitmedia
Alternative 5	P5	AdEx

Source: Author

There are five choices of blockchain marketing platforms. These platforms are well-known and should be evaluated by experts who possess a deep understanding of them and relevant experience.

Brave: developed by Brave Software, Inc., is a free and open-source web browser designed for Web 3. It focuses on enhancing privacy by automatically blocking tracking cookies and online advertisements on websites.
Coinzilla: Founded in 2016, Coinzilla is one of the leading crypto advertising networks, providing valuable assistance to marketers and entrepreneurs in promoting their blockchain and cryptocurrency projects.

Adshares: is a decentralized advertising blockchain platform designed to offer advertisers a swift, lightweight, and secure blockchain solution tailored to the needs of the advertising technology sector.

Bitmedia: is an artificial intelligence-driven advertising platform that was introduced in 2015. Advertisers on Bitmedia can utilize a range of targeting choices, such as geographic targeting, device targeting, scheduling, and frequency capping.

AdEx: which was initiated in 2017, stands as one of the pioneering decentralized advertising networks utilizing the Ethereum blockchain and smart contracts. Its primary objective is to eliminate ad fraud and ensure that advertisers are billed solely for genuine clicks.

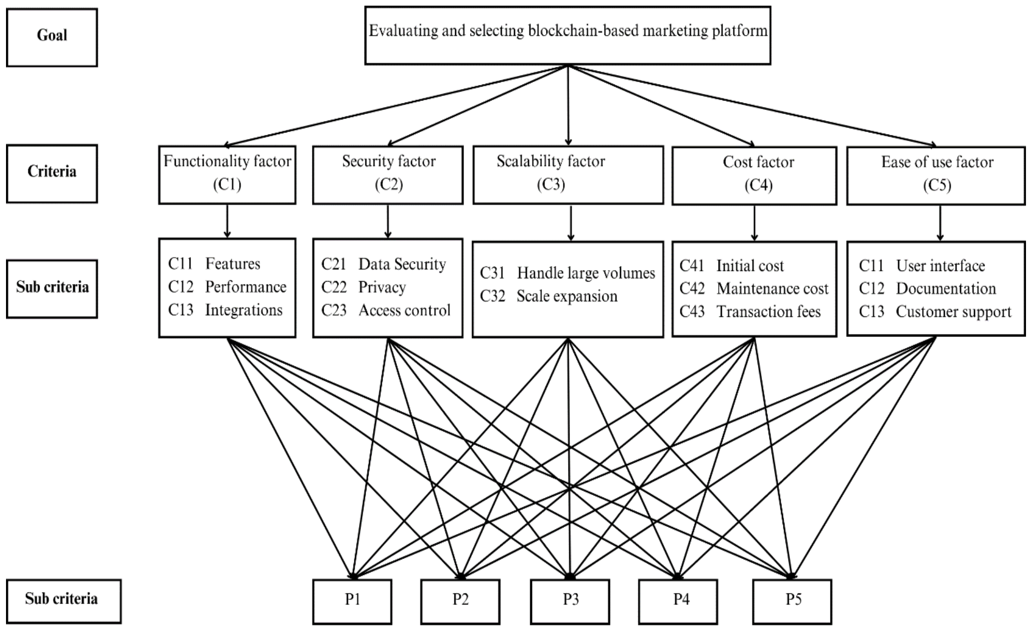

Figure 3.2. Hierarchical structure of application

The TOPSIS method, developed by Hwang and Yoon in 1981, serves as a multi-criteria decision-making technique. They designed TOPSIS to determine the alternative with the shortest distance to the positive-ideal solution and the farthest distance to the negative-ideal solution, according to their concepts (Shyjith et al., 2008; Monjezi et al., 2010)

The following steps are followed in the TOPSIS method:
Step 1: Determining objectives and defining evaluation criteria
Step 2: Creating the Decision Matrix (D): In the decision matrix, the alternatives (a1 ... an) are listed one under the other and the characteristics of each criterion compared to the alternatives (y1k ... ynk) are listed (Yurdakul and Ic, 2003). Creating the decision matrix number 8 is given in equality

$$D = \begin{bmatrix} y_{11} & y_{12} & \cdots & y_{1k} \\ y_{21} & y_{22} & \cdots & y_{2k} \\ \cdots & \cdots & \cdots & \cdots \\ y_{n1} & y_{n2} & \cdots & y_{nk} \end{bmatrix} \quad (8)$$

Step 3: Creating the Normalized Decision Matrix (R):
To normalize the matrix, the square root of the sum of the squares of the scores or features related to the criteria is taken (Yurdakul and Ic, 2003). Equation 9 is applied for normalization, resulting in the R matrix as shown in equation 10.

$$r_{ij} = \frac{y_{ij}}{\sqrt{\sum_{i=1}^{n} y_{ij}^2}} \qquad i = 1, 2, \dots, m \text{ and } j = 1, 2, \dots, k \quad (9)$$

$$R = \begin{bmatrix} r_{11} & r_{12} & \cdots & r_{1k} \\ r_{21} & r_{22} & \cdots & r_{2k} \\ \cdots & \cdots & \cdots & \cdots \\ r_{n1} & r_{n2} & \cdots & r_{nk} \end{bmatrix} \quad (10)$$

Step 4: Creating the Weighted Normalized Decision Matrix (V):
For each element of the decision matrix, normalized based on the purpose, where "j" represents the weight of the criterion. The relative weight values are determined according to the importance assigned to the criteria (Monjezi et al., 2010).

$$W = \begin{bmatrix} w_{11} & w_{12} & \cdots & w_{1k} \\ w_{21} & w_{22} & \cdots & w_{2k} \\ \cdots & \cdots & \cdots & \cdots \\ w_{n1} & w_{n2} & \cdots & w_{nk} \end{bmatrix} \quad (11)$$

Subsequently, each column's elements from the R matrix, as presented in equation 10, are used to form the V matrix, as shown in equation 12, by multiplying them with the corresponding wij values from equation number. This matrix creation process is in line with the methodology proposed (Monjezi et al., 2010).

$$V = \begin{bmatrix} v_{11} & v_{12} & \cdots & v_{1k} \\ v_{21} & v_{22} & \cdots & v_{2k} \\ \cdots & \cdots & \cdots & \cdots \\ v_{n1} & v_{n2} & \cdots & v_{nk} \end{bmatrix}$$

(12)

Step 5: Identify the Positive Ideal (A+) Solution and Negative Ideal (A-) Solutions:
The Positive Ideal Solution (PIS) is composed of the best-performing values found in the solution-weighted normalized decision matrix, while the Negative Ideal Solution (NIS) includes the worst values (Shyjith et al., 2008). These ideal solutions can be computed using Equation 14.

$$A^{+} = \left\{ \left(\max_{i} v_{ij} \middle| j \in J \right), \left(\min_{i} v_{ij} \middle| j \in J \right) \right\} \quad (13)$$

$$A^{-} = \left\{ \left(\min_{i} v_{ij} \middle| j \in J \right), \left(\max_{i} v_{ij} \middle| j \in J \right) \right\} \quad (14)$$

Both equations represents the benefit (maximization) value, and J represents the cost (minimization) value (Monjezi et al., 2010). The values computed from equation number 13 result in A+ = {v1+, v2+, ..., vk+}, while the values derived from equation number 14 yield A- = {v1-, v2-, ..., vk-}.

Step 6: Calculation of $\mathbf{S}_i{}^+$ (distance from option i to positive ideal solution $\mathbf{A}^+$) and $\mathbf{S}_i{}^-$ (distance from option i to negative ideal solution $\mathbf{A}^-$) is performed according to following formula:

$$\mathbf{S}_i{}^+ = \sqrt{\sum_{j=1}^{n}\left(v_{ij} - v_j^+\right)^2} \tag{15}$$

$$\mathbf{S}_i{}^- = \sqrt{\sum_{j=1}^{n}\left(v_{ij} - v_j^-\right)^2} \tag{16}$$

Step 7: Calculating the closeness to Ideal Solution ($\mathbf{CC}_i$) using the method described in equation 17 (Monjezi et al., 2010).

$$\mathbf{CC}_i = \frac{\mathbf{S}_i{}^-}{\mathbf{S}_i{}^- + \mathbf{S}_i{}^+} \qquad \mathbf{0} \le \mathbf{CC_i} \le \mathbf{1} \tag{17}$$

Step 8: Based on the index 〖CC〗_i, we can determine the ranking order of the options, thereby finding the best choice among the initially given options (Monjezi et al., 2010).

4. RESULTS

Step 1: A hierarchical framework of criteria and sub-criteria is used to design the problem as given in Figure 3.2

Step 2: Pairwise Comparison Matrices (A) and Determination of Relative Significance

Table 4.2. Aggregated pairwise comparison matrix for main criteria

	C1	C2	C3	C4	C5
C1	1.00	5.00	5.67	6.17	6.50
C2	0.20	1.00	1.48	1.78	1.92
C3	0.19	2.03	1.00	2.56	2.56
C4	0.17	1.33	0.96	1.00	1.92
C5	0.16	0.83	0.78	0.92	1.00
Summary	1.72	10.19	9.88	12.42	13.89

Source: Author

Table 4.3. Aggregated pairwise comparison matrix for sub-criteria (C11 - C13)

	C11	C12	C13
C11	1.00	2.67	1.79
C12	1.61	1.00	0.95
C13	2.34	2.50	1.00
Summary	4.95	6.17	3.74

Source: Author

Table 4.4. Aggregated pairwise comparison matrix for sub-criteria (C21 – C23)

	C21	**C22**	**C23**
C21	1.00	3.85	2.26
C22	1.59	1.00	0.74
C23	1.90	3.06	1.00
Summary	4.48	7.91	4.01

Source: Author

Table 4.5. Aggregated pairwise comparison matrix for sub-criteria (C31 – C32)

	C31	**C32**
C31	1.00	2.47
C32	1.05	1.00
Summary	2.05	3.47

Source: Author

Table 4.6. Aggregated pairwise comparison matrix for sub-criteria (C41 – C43)

	C41	**C42**	**C43**
C41	1.00	1.94	2.97
C42	1.65	1.00	2.53
C43	1.01	1.13	1.00
Summary	3.66	4.07	6.51

Source: Author

Table 4.7. Aggregated pairwise comparison matrix for sub-criteria (C51 – C53)

	C51	**C52**	**C53**
C51	1.00	1.51	1.20
C52	2.76	1.00	1.75
C53	2.79	2.08	1.00
Summary	6.55	4.60	3.95

Source: Author

Step 3: Calculating the Eigenvector (Relative Importance Vector) from Pairwise Comparisons

Table 4.8. Pairwise comparison matrix normalization for main criteria

	C1	**C2**	**C3**	**C4**	**C5**	**Criteria Weight**
C1	0.58	0.52	0.61	0.52	0.49	0.54
C2	0.12	0.10	0.12	0.13	0.13	0.12
C3	0.11	0.18	0.12	0.19	0.17	0.16
C4	0.10	0.12	0.08	0.09	0.13	0.10
C5	0.09	0.08	0.07	0.07	0.08	0.08

Source: Author

Table 4.9. Pairwise comparison matrix normalization for sub-criteria (C11 - C13)

	C11	C12	C13	Criteria Weight
C11	0.35	0.34	0.36	0.35
C12	0.27	0.23	0.22	0.24
C13	0.38	0.43	0.41	0.41

Source: Author

Table 4.10. Pairwise comparison matrix normalization for sub-criteria (C21 – C23)

	C21	C22	C23	Criteria Weight
C21	0.38	0.40	0.40	0.39
C22	0.20	0.21	0.21	0.21
C23	0.41	0.39	0.39	0.40

Source: Author

Table 4.11. Pairwise comparison matrix normalization for sub-criteria (C31 – C32)

	C31	C32	Criteria Weight
C31	0.61	0.61	0.61
C32	0.39	0.39	0.39

Source: Author

Table 4.12. Pairwise comparison matrix normalization for sub-criteria (C41 – C43)

	C41	C42	C43	Criteria Weight
C41	0.41	0.43	0.40	0.41
C42	0.36	0.37	0.38	0.37
C43	0.23	0.20	0.22	0.22

Source: Author

Table 4.13. Pairwise comparison matrix normalization for sub-criteria (C51 – C53)

	C51	C52	C53	Criteria Weight
C51	0.25	0.24	0.26	0.25
C52	0.37	0.35	0.34	0.35
C53	0.38	0.41	0.40	0.40

Source: Author

Step 4: Calculating Eigenvector Consistency

Table 4.14. Calculate the consistency for main criteria

	C1	C2	C3	C4	C5	Weighted Sum Value	Criteria Weight	Consistency vector
C1	0.54	0.61	0.77	0.61	0.50	3.03	0.54	5.58
C2	0.11	0.12	0.14	0.14	0.12	0.64	0.12	5.21
C3	0.10	0.22	0.16	0.21	0.16	0.85	0.16	5.38

C4	0.09	0.13	0.10	0.10	0.12	0.54	0.10	5.20
C5	0.09	0.08	0.08	0.08	0.08	0.41	0.08	5.23
				λ_{max}				5.32

Source: Author

After calculating λ_{max} based on Equation number 4, we do the calculation of the CR on Equation number 5:

CI: 0.08
RI: 1.11
CR: 0.07

Because CR = 0.07 < 0.1, expert reviews are consistent.

Table 4.15. Calculate the consistency for sub-criteria (C11 - C13)

	C11	C12	C13	Weighted Sum Value	Criteria Weight	Consistency vector
C11	0.35	0.37	0.36	1.08	0.35	3.05
C12	0.29	0.24	0.22	0.74	0.24	3.04
C13	0.39	0.45	0.41	1.24	0.41	3.05
				λ_{max}		3.05

Source: Author

After calculating λ_{max} based on Equation number 4, we do the calculation of the CR on Equation number 5:

CI: 0.02
RI: 0.58
CR: 0.04

Because CR = 0.04 < 0.1, expert reviews are consistent.

Table 4.16. Calculate the consistency for sub-criteria (C21 – C23)

	C21	C22	C23	Weighted Sum Value	Criteria Weight	Consistency vector
C21	0.39	0.38	0.47	1.24	0.39	3.10
C22	0.22	0.21	0.21	0.63	0.21	3.02
C23	0.46	0.37	0.40	1.23	0.40	3.08
				λ_{max}		3.06

Source: Author

After calculating λ_{max} based on Equation number 4, we do the calculation of the CR on Equation number 5:

CI: 0.03
RI: 0.58
CR: 0.06

Because CR = 0.06 < 0.1, expert reviews are consistent.

Table 4.17. Calculate the consistency for sub-criteria (C31 – C32)

	C31	C32	Weighted Sum Value	Criteria Weight	Consistency vector
C31	0.61	0.61	1.21	0.61	2.00
C32	0.39	0.39	0.79	0.39	2.00
			λ_{max}		2.00

Source: Author

The calculation results in Table 4.13 do not need to calculate the CR consistency index because the number of criteria is 2

Table 4.18. Calculate the consistency for sub-criteria (C41 – C43)

	C41	C42	C43	Weighted Sum Value	Criteria Weight	Consistency vector
C41	0.41	0.45	0.39	1.26	0.41	3.04
C42	0.36	0.37	0.38	1.11	0.37	3.03
C43	0.24	0.20	0.22	0.66	0.22	3.02
λ_{max}						3.03

Source: Author

After calculating λ_{max} based on Equation number 4, we do the calculation of the CR on Equation number 5:

CI: 0.01
RI: 0.58
CR: 0.03

Because CR = 0.03 < 0.1, expert reviews are consistent.

Table 4.19. Calculate the consistency for sub-criteria (C51 – C53)

	C51	C52	C53	Weighted Sum Value	Criteria Weight	Consistency vector
C51	0.25	0.24	0.27	0.76	0.25	3.03
C52	0.37	0.35	0.35	1.07	0.35	3.02
C53	0.38	0.43	0.40	1.20	0.40	3.04
λ_{max}						3.03

Source: Author

After calculating λ_{max} based on Equation number 4, we do the calculation of the CR on Equation number 5:

CI: 0.01
RI: 0.58
CR: 0.03

Because CR = 0.03 < 0.1, expert reviews are consistent.

Step 5: Calculate the global weight of the criteria: Using Equation 6 and Equation 7 to global weight.

Table 4.20. Global weight for each criteria

Main criteria		Sub - criteria	Local weight	Global weight	Ranking
C1	0.54	**C11**	0.35	0.19	2
		C12	0.24	0.13	3
		C13	0.41	0.22	1
C2	0.12	**C21**	0.39	0.05	7
		C22	0.21	0.03	12
		C23	0.40	0.05	6
C3	0.16	**C31**	0.61	0.09	4
		C32	0.39	0.06	5
C4	0.10	**C41**	0.41	0.04	8
		C42	0.37	0.04	9
		C43	0.22	0.02	13
C5	0.08	**C51**	0.25	0.02	14
		C52	0.35	0.03	11
		C53	0.40	0.03	10

Source: Author

Based on Table 4.20 the weighted 5 main criteria are Functionality factor (C1), Security factor (C2), Scalability factor (C3), Cost factor (C4), and Ease of use factor (C5) with 14 sub-criteria. It can be seen that Integrations (C13) is the highest criterion with 22.09%, followed by Features (C11), and Performance (C12) with 18.99%, and 13.24%, respectively. In addition, low-weight criteria such as Transaction fees (C43) with 2.25%, and User interface (C51) with only 1.94%. It can be said that the criterion with the highest volume has a higher importance.

4.2.2 TOPSIS.

This study uses the Technique for Order of Preference by Similarity to Ideal Solution (TOPSIS) method to rank Blockchain-based marketing platforms. The evaluation criteria are derived from a review of related works and expert opinion.

Step 1: Determining objectives and defining evaluation criteria

Step 2: Creating the Decision Matrix (D)

Table 4.21. The decision matrix ranks marketing platform for each criterion

	C1	C2	C3	C4	C5
P1	5.500	3.554	3.440	5.685	4.885
P2	4.227	3.583	2.804	5.685	3.521
P3	3.083	4.778	3.833	2.021	1.260
P4	4.389	3.873	2.133	2.750	3.050
P5	4.333	5.333	2.283	3.326	2.774
	9.781	9.578	6.645	9.346	7.406

Source: Author

Step 3: Creating the Normalized Decision Matrix (R):

Table 4.22. The decision matrix normalized the ranking of marketing platform for each criterion

	C1	C2	C3	C4	C5
P1	0.562	0.371	0.518	0.608	0.660
P2	0.432	0.374	0.422	0.608	0.475
P3	0.315	0.499	0.577	0.216	0.170
P4	0.449	0.404	0.321	0.294	0.412
P5	0.443	0.557	0.344	0.356	0.375

Source: Author

Step 4: Creating the Weighted Normalized Decision Matrix (V):

Table 4.23. Weighted Normalized Decision Matrix

	C1	C2	C3	C4	C5
P1	0.112	0.074	0.104	0.122	0.132
P2	0.086	0.075	0.084	0.122	0.095
P3	0.063	0.100	0.115	0.043	0.034
P4	0.090	0.081	0.064	0.059	0.082
P5	0.089	0.111	0.069	0.071	0.075

Source: Author

Step 5: Identify the Positive Ideal Solution (PIS) and Negative Ideal Solution (NIS)
These ideal solutions can be computed using Equations 13 and 14.

Table 4.24. Positive Ideal Solution (PIS) and Negative Ideal Solution (NIS) of each criterion

	C1	**C2**	**C3**	**C4**	**C5**
A^+	0.112	0.111	0.115	0.122	0.132
A^-	0.063	0.074	0.064	0.043	0.034

Source: Author

Step 6: Calculation of S_i^+ and S_i^- is performed according to Equations 15 - 16:

Table 4.25. The gap between marketing platform options

	S_i^+	S_i^-
P1	0.039	0.140
P2	0.066	0.104
P3	0.135	0.057
P4	0.102	0.058
P5	0.092	0.067

Source: Author

Step 7: The calculated closeness coefficient (CC_i)

Table 4.26. Closeness coefficient Cci

	CC_i
P1	0.783
P2	0.613
P3	0.297
P4	0.361
P5	0.421

Source: Author

Step 8: Determine the ranking order of the choices to identify the optimal selection among the initially provided options.

Table 4.27. Marketing platform Ranking

	Ranking
P1	1
P2	2
P3	5
P4	4
P5	3

Source: Author

As you can see in Table 4.27, the Blockchain-based Marketing platform with the highest star rating is P1 (Brave) with a score of 0.783, marketing platforms are followed by P2 (Coinzilla), P4 (Bitmedia), P5 (AdEx), and lowest rank the most is P3 (Adshares) with scores of 0.613; 0.421; 0.361 and 0.297 respectively. And in the ranking, P1 (Brave) is the clear leader in the ranking, with a score of 0.783. Brave is a popular web browser that is known for its privacy-focused features and its support for blockchain-based advertising. Brave's advertising platform allows users to opt-in to see ads and earn cryptocurrency in exchange for their attention. P2 (Coinzilla) and P5 (AdEx) are also highly rated, with scores of 0.613 and 0.421 respectively. Coinzilla is a well-known advertising platform that supports a variety of cryptocurren cies. AdEx is a decentralized advertising platform that is still under development. P4 (Bitmedia) and P3 (Adshares) are ranked lower, with scores of 0.361 and 0.297 respectively. Bitmedia is a Chinese advertising company that offers a variety of advertising services, including blockchain-based advertising. Adshares is a decentralized advertising platform that allows users to buy and sell ad space using blockchain technology.

5. CONCLUSIONS

The blockchain marketing platform industry is still in its early stages of development, but it is attracting increasing interest from both marketers and advertisers. Blockchain marketing platforms offer a number of potential advantages over traditional marketing platforms, including Functionality, Security, Scalability, Cost, and Ease of use. These factors are critical for marketers and advertisers in today's market, and they are emerging as extremely relevant and important considerations in platform selection and go-to-market strategies. After evaluating the criteria based on expert opinions, interview data, and conducting data analysis using the AHP-TOPSIS method, the results indicate that Brave is ranked first and considered a good platform. Coinzilla is ranked second, AdEx is ranked third, Bitmedia is ranked fourth, and Adshares is ranked last. Additionally, the author performed a sensitivity analysis to assess the sensitivity of the data, thereby ensuring the reliability of the results.

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